

ission Statement

The mission of the Alberta Research Council is to advance the economy of the province by promoting technology development and application, performing applied research, and providing expert advice, technical information and scientific infrastructure that is responsive to the needs of the private sector and supports the activities of the public sector.

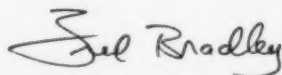
The Alberta Research Council is a member of the Association of Provincial Research Organizations (APRO).

Letter of Transmittal

To The Honourable Fred A. Stewart
Minister of Technology, Research & Telecommunications

In accordance with the requirements of the Alberta Research Council Act, I have the honor to present to you the Annual Report of the Alberta Research Council for the calendar year 1991.

Respectfully submitted,



Fred D. Bradley, M.L.A.
Chairman of the Board
Alberta Research Council

February 1992



Chairman's Message

This year was a momentous one for the Alberta Research Council as we celebrated the corporation's 70th anniversary. With pride, we looked back at the achievements of those who founded and shaped organization. At the same time, we affirmed our commitment to the future direction of the corporation in our mission to support the economy of the province.

As the province's premier research organization, the Research Council's mandate is to advance the economy of Alberta through research and technology development and application. We believe that the Research Council should continue to provide leadership in introducing new technology and effecting technology transfer. Earlier this year, we unveiled our corporate plan, *A Vision to the Year 2000*, which provides the framework to take the Research Council into the next century. This document identifies the challenges and sets out the priorities for the years ahead. It commits us to an aggressive, outward-looking perspective and it has the endorsement of the Research Council's Board of Directors and the Government of Alberta.

The driving force behind *A Vision to the Year 2000* was Clem Bowman, who retired in May. Launching the document was the culmination of his four years as president of the Alberta Research Council; his vision, energy and determination inspired many changes that will endure as the Research Council pursues its goals for the 1990s.

The Board of Directors was pleased to support the appointment, June 1, of Brian L. Barge as president. Dr. Barge, who joined the corporation staff in 1972, has the distinction of being the first president of the Research Council appointed from within the organization. It is his mandate to implement *A Vision to the Year 2000*, and we look to his leadership to take us forward in helping Alberta industries develop and apply technology to meet the demands of the global marketplace.

At an annual awards dinner hosted by the Board, the directors take great pleasure in being able to congratulate staff who have earned the recognition of their peers. The 1990 award winners are listed on pages 20 and 21. This year the Research Council's new Technology Transfer Award was introduced at the awards ceremony. The Technology Transfer Award was established to recognize outstanding achievement to the organization through the transfer of a significant technological activity from within the Alberta Research Council into the private or public sector. On behalf of the Board of Directors, I warmly congratulate the

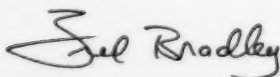


first winners of the award: the joint research venture team from Advanced Computing and Engineering that worked with Dataspan Technology, Inc. of Calgary, to develop a software system, recognized as one of the best products available for cartographic document conversion.

Many concerned citizens and institutions today are working to raise awareness of science and technology as the key to our country's future in globally competitive markets. The response to the Alberta Research Council's efforts in this regard indicates that Alberta audiences are eager and interested to learn about our research community. Last spring, a panel discussion on education drew an overflow audience to hear a spirited debate about the need to train students for potential careers in science. In October, more than 5,000 people, including several hundred students, visited our Edmonton and Calgary facilities during National Science and Technology Week. Many of our research staff regularly visit school children in their classrooms and, for the third year, the Research Council offered interested teachers an opportunity to spend six weeks during the summer working in our laboratories. I believe this community outreach is significant and goes beyond the goal of boosting science awareness. These events help foster science literacy and meaningful associations between the Alberta Research Council, the educational constituency, and the general public.

Board of Directors

We welcomed three new colleagues to the Board this year: Leonard F. Bolger, retired vice-president, Shell Canada, and now vice president, Canadian Institute for Advanced Research, Calgary; Ray F. Fortune, president and CEO, TR Labs, Edmonton; and Dr. Howard E. Tennant, president of the University of Lethbridge, and joining them, Dr. Barge as president of the Alberta Research Council.



Fred D. Bradley, M.L.A.

Chairman of the Board

December 1991



resident's Message

The Alberta Research Council is committed to providing a consolidated research capability to support the needs of industry, and the needs of government departments and agencies that cannot be provided by the private sector. The core of our activity is the conduct of credible and innovative science and technology. Highlights of our year's work are recorded in this annual report.

Challenge and change have been the driving factors in activities of the Alberta Research Council during 1991, continuing a trend for the 1990s. We launched *A Vision to the Year 2000*, our corporate plan that is the framework for the Alberta Research Council's operations to take us into the 21st century. The plan outlines our objectives, strategies, and our commitment to the public and private sectors which we serve. It lays out the measures by which we, and others, can judge our success. My mandate, in assuming the presidency of the Research Council in June, is to fully implement *A Vision to the Year 2000*.

Our bottom line is wealth generation in Alberta through private and public sector activity. In order to make the results of our scientific and technological endeavors more readily accessible for the benefit of our stakeholders, we will strengthen the business aspects within the corporation. We have determined we need to improve the quality of our business practices to include clear measures of performance. These measures of success must relate to our mission to advance the economy of the province. We have identified some of these measures: creating new wealth, making a positive impact on the Gross Domestic Product, offering employment and growth potential, licensing agreements, companies attracted to the province, stakeholder satisfaction, and return on research investment. Applying these parameters means that market research, designed to determine the potential for commercial success from our science and technology, will be an increasingly important practice at the Alberta Research Council.

In December, Dr. Robert J. Fessenden was appointed vice-president of Development and Planning, and Dr. M.P. du Plessis succeeds him as vice-president of Resource Technologies. Exploitation of our work and technology commercialization will be firmly connected to the marketplace. Dr. Fessenden's portfolio has been strengthened to provide a more vigorous effort in technology management and marketing, building on earlier strategic planning, and strategic alliances initiatives.



Our number one priority continues to be a safe and healthy work environment for all staff. Intellectual capital of staff is also vital to corporate success in the knowledge-based global economy of this decade, and into the 21st century. People are our most important resource and they are the Research Council's most significant investment. To protect this investment, we recognize the need to offer improved training opportunities. In 1991, the Alberta Research Council implemented a skills enhancement program to integrate selected staff into Research Council programs that require new skills.

The Alberta Research Council is often called upon by the provincial government to manage or support initiatives of various departments or external entities. The Kananaskis air quality group from the University of Calgary and the wildlife program from the Alberta Environmental Centre were incorporated into Research Council departments last year. In 1991, the research programs of Chembiomed Ltd. were transferred to the Alberta Research Council and we welcomed 24 former Chembiomed staff into the Research Council family. This carbohydrate research group will focus on the most promising areas of their bio-medical research, based on the work of Dr. Ray Lemieux at the University of Alberta. We intend this research to lead to industrial alliances for the development of new therapeutics for inflammatory and auto-immune diseases, anti-viral compounds and innovative vaccine delivery systems.

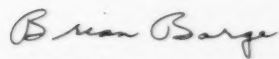
In December, an agreement was signed between the Alberta Research Council and Eniricerche, the research arm of the ENI Group of Italy, to link the Research Council's agglomeration technology to Eniricerche's coal slurry technology, and develop an integrated technology for coal slurry transportation. A number of other cooperative activities undertaken in 1991 which we expect to come to fruition next year include: commercialization of agglomeration technology, particularly soil clean-up; closer integration of environmental research activities between the Alberta Research Council and Alberta Environment; and a corporate response to the federal government's Green Plan.

While a major effort has been expended in setting the vision and corporate goals for the future, I believe the Alberta Research Council must constantly look at its program elements from a more strategic perspective. This role is strongly supported by program advisory committees, with industrial representation. Following from the corporate plan, our Board of Directors will play a major role in setting the course towards *A Vision to the Year 2000*. We have, in our Board, a group of astute men and women, attuned to the considerable changes and challenges which affect this organization. Their counsel will continue to be pivotal.



Finally, to achieve *A Vision to the Year 2000*, it is essential to better link the corporation to other organizations that are integral components of the wealth generation process – the universities, technology transfer corporations, venture capital companies and market research organizations. Activities in this area will be strengthened in 1992.

I am proud to lead this vibrant organization and, at the same time, to work alongside such a talented and dedicated group of men and women. I have the utmost confidence in our ability to meet our future challenges with enthusiasm and commitment.



Brian L. Barge
President

December 1991

Corporate Profile

Advanced Computing and Engineering: Computer-based technology including automation, expert systems and robotics for application and transfer to industry.

Alberta Geological Survey: Characterization of oil sand, coal, industrial and metallic minerals; hydrocarbon reservoir analysis and characterization; studies related to deep disposal of liquid wastes; metallic mineral core library.

Biotechnology: Microbiology; fermentation technology and scale up; bioprocess engineering; interim manufacturing of products for client companies; research into bio-active carbohydrates.

Coal and Hydrocarbon Processing: Hydrocarbon upgrading process research including heavy oil, bitumen, distillates, coal and natural gas. Projects in agglomeration, gasification, combustion, co-processing; hydrocarbon upgrading; classification and evaluation of Alberta coals by pyrolysis and petrography.

Electronics Test Centre: Testing and evaluation services for electronic and telecommunications products manufacturers requiring product certification; engineering assistance for companies planning and developing new products.

Environmental Research and Engineering: Prevention and remediation of soil, groundwater and atmospheric contamination; modelling of river effluents; land spreading of industrial wastes; management and modelling of land resource information; land reclamation; engineering technology in support of design and protection of highways and bridges; design and fabrication of custom electronics; spatial information technology applications.

Forestry: Development and testing of products using Alberta forest resources; development of forestry management technology; wildlife habitat and ecological studies within Alberta; humane trapping development.

Manufacturing Technologies: Advanced manufacturing technology applications; industrial engineering R&D; waste management and recycling; industrial materials, chemicals and products testing; application of advanced materials; analytical chemistry; gasoline and oil testing. Joint Research Venture Program: sharing resources with participating companies to take innovative and marketable technology to commercial development. Industrial Technology Advisor Network: providing short-term advisory and technical service; delivery of National Research Council IRAP services to Alberta industry.

Oil Sands and Hydrocarbon Recovery: Thermal heavy oil and enhanced recovery investigations; physical and numerical simulations; waxy crude studies; production and pipelining studies; technical and economic evaluation and modelling; maintenance of an oil sand sample bank.



he Year in Review

Advanced Computing and Engineering

During 1991, 30 projects, 60 per cent of which are with the private sector, were under way in this department.

A software system, called FleetPlanner, was developed for Greyhound Lines of a Canada Ltd. which operates a fleet of 400 buses. The expert system provides Greyhound managers with an effective decision support tool to analyse the impact of marketing and operational decisions such as adding new routes and maintenance facilities or buying new buses.

The Alberta Research Council joined with several private and public sector partners in a five-year applied research project to develop an intelligent graphic interface for use in control centres. In an effort to provide user-friendly systems for the operators of real-time supervisory systems, prototypes are being developed and placed in control centres of TransAlta Utilities Corporation and B.C. Telephone Company. The Research Council's involvement is in the areas of user modelling studies, multi-user collaborations, and the development of the computer system architecture. This is a project of PRECARN Associates Inc., a Canadian research consortium.

Under a contract for IBM Canada Ltd., researchers developed a support system for trouble-shooting personal computer boards. Co-Pilot, a machine learning program, aids in diagnosis of faulty printed circuit boards. This was a joint project with the National Research Council ACT laboratory.

A series of contracts to develop an automated process planning system for Northern Telecom Canada Ltd. have been completed. A computer programmed manufacturing and assembly planning system identifies the operations, resources and time required to assemble electronic components for the manufacture of printed circuit boards. In another project for Northern Telecom, staff developed an expert system for fault diagnosis in a computer-integrated manufacturing factory. This knowledge-based approach to fault diagnosis of manufacturing equipment assists operators in determining the causes of failures.

Environment-related project HERMES (Heuristic Emergency Response Management Expert System) is a computer expert system that helps emergency response personnel to deal with hazardous situations involving dangerous goods. The user-friendly prototype, developed by the department together with



Alberta Public Safety Services and Emergency Preparedness Canada, successfully demonstrated the application of artificial intelligence techniques to emergency response management and training. Syncrude Canada is a member of the consortium funding continued development. The project team will investigate incorporating more robust environmental models, integrating the expert system with a geographical information system, and linking to a weather satellite.

Researchers are developing new technology for remotely controlling robotic devices in two projects with International Submarine Engineering Ltd. and Thomson-CSF Systems Canada Ltd. This work is funded by the Canadian Space Agency's STEAR (Strategic Technologies in Automation and Robotics) program and is directed towards providing effective ground control capabilities for the robot system which is Canada's contribution to the U.S. Space Station program. This new control technology will have applications in the resource industries, enabling the use of robots in activities such as mining and forest management.

Alberta Geological Survey

During 1991 the Alberta Geological Survey completed five new regional coal maps as part of its coal compilation project. These regional maps are used to support exploration and land-use planning. Mapping activity was focused in the foothills belt of west-central Alberta, north and east of Grand Cache. This three-year program began in 1990 as series of 15 1:50 000 scale mapsheets. Each map is designed to be a stand-alone product contributing to an overall synthesis of information. The coal compilation project is an initiative developed by the Alberta Geological Survey in consultation with the coal industry and the provincial government. In addition to publicly available information, a substantial portion of the data for producing these maps is donated by the coal industry.

Alberta has more than 30 different potentially economic industrial and metallic minerals other than oil, gas and coal, spread over at least 1,500 known occurrences. Data on the location, geologic setting and resource potential of these mineral occurrences have been captured by Alberta Geological Survey geologists in a computer-based file called Alberta Mineral Deposits and Occurrences. Access to the information, using automated file searching methods, has been made available on both Macintosh and PC-DOS compatible computers. Another means of access to Alberta minerals data will be through a Geoscience Information System (GSIS) currently under development. A pilot study was completed for the



Bow Valley Corridor region, and the procedures developed from this pilot are being applied to produce an operational GSIS package for the entire province.

Biotechnology

Emphasis on the commercial production capabilities of the biotechnology pilot plant resulted in new clients and the generation of significant revenue in 1991. The pilot plant is producing fish vaccine for a major client, Aqua Health Ltd., Charlottetown, P.E.I., suppliers to the Norweigan fish farming industry. The Research Council continues to supply Byosis of California with three biological pesticides - Bio-Safe, Bio-Safe-N, and Bio-Vector - for the U.S. market. The department developed the process for the production of agricultural inoculants to stimulate nitrogen fixation for another client, Urbana Laboratories. Other new research clients include BioXan (Canada) Inc. and Grow Tec Inc. For BioXan, the department is contributing to the development of a new biopolymer process, employing a novel agitation system, especially applicable to high viscosity fermentation. The product will be used in oil recovery or food processing applications. The work with Grow Tec is a joint research venture contract to develop a process for cultivar-specific *Rhizobium* species.

The consolidation of business with production has also allowed the department to engage in more technically demanding, and more lucrative developmental research. These projects are characterized by products higher in value and lower in volume requirement. The Biotechnology department also has put in place Good Manufacturing Practice compliance to meet United States Food and Drug Administration requirements for animal biologics, and U.S. Department of Agriculture requirements for fish vaccines. Being able to meet these standards will expand markets for clients exporting to the U.S.

In 1991, the installation of a downstream processing laboratory in the pilot plant was completed.

Coal and Hydrocarbon Processing

In a bitumen upgrading program jointly funded by AOSTRA (Alberta Oil Sands Technology Research Authority) and the Alberta Research Council, a comprehensive operational performance database is being generated for the design of a demonstration-scale pilot plant. Expertise in the control and prevention of coke formation in an upgrader is being shared with Syncrude Canada Ltd. Further improvements have been made in catalyst performance, coal and resid copping, and refining.



In catalyst work, an improved process for the conversion of syngas (carbon monoxide and hydrogen) to gasoline-type hydrocarbons using a new catalyst (S-G catalyst) has been developed on behalf of a private sector company. New catalysts also have been successfully applied for improved 'wet air oxidation' destruction of organic contaminants in aqueous effluent.

Research jointly sponsored by Alberta Energy, Shell Canada and the Alberta Research Council is directed to development of novel ceramic membranes for the high temperature separation of hydrogen.

New electrodes for hydrogen sulfide electrolysis to produce both sulfur and hydrogen have been prepared. A program of testing this method is being conducted in collaboration with Alberta Energy, with the aim of involving industry in the future.

Work performed by the Alberta Research Council, within a consortium of Canadian and U.S. companies and agencies over a period of three and one-half years, has led to the development of three proprietary technologies. Pyrite rejection technology for beneficiation of high sulfur coals has been successfully scaled up to a 100 T/day pilot plant. Application of agglomeration technology to low rank coal/heavy oil upgrading technology is being developed for use in Canada. Exploitation of the technology for tarry oil waste remediation technology is being promoted to address environmental clean up. Working with Alberta Environment, this clean soil process has been assessed as a cost-effective technique in remediation of creosote-contaminated gravel in the Bow River.

A consortium approach to work with both government and industry has been successfully applied to a number of department projects. A Canadian coal gasification research and development consortium has been established with funding from industry, federal and provincial governments. Research will be performed jointly by the Alberta Research Council and CANMET. A study on the impact of quality on the utilization potential of Alberta subbituminous coals, funded by Alberta Office of Coal Research and Technology and TransAlta Utilities, has been initiated. Improved methods for production of value-added products from coal such as activated carbon and carbon fibers, are under development. Coal combustion activities were expanded to include sampling and measurement in industrial-scale pulverized coal flames. Measurements of gas temperature, composition and heat transfer characteristics were completed at a demonstration-scale test of a novel coal burner application at Cold Lake. Another industry consortium sponsored a study of the coal bed methane potential of Alberta coals.



Electronics Test Centre

The Electronics Test Centre completed 209 projects for 91 clients. This work included 143 projects for 47 Alberta companies, which represents 95 per cent of the Alberta testing market.

The Test Centre continued to attract international clients and projects. A working arrangement with the Hong Kong Productivity Council has resulted in a project for the Test Centre. A Memorandum of Understanding was signed with the Standards, Testing and Quality Control Directorate, Government of India, opening the door to a potential market for Canadian manufacturers.

Securiplex Technologies Inc., Quebec, has a contract to supply fire detection and control systems for the wagons to transport vehicles through the channel tunnel being built between England and France. The Test Centre is performing testing for the Securiplex system to meet stringent European standards.

The Test Centre's policy of superior client service and client satisfaction continues to be monitored through questionnaires and interviews for every completed project. The questionnaire covers the same four key areas as last year: service quality, responsiveness, staff attitude and price. The overall rating for 1991 increased to 4.6 out of a possible 5, from 4.2 last year.

Environmental Research and Engineering

Air pollution prediction and monitoring are essential requirements for sound air quality planning in future industrial and urban development. The value of computer models, designed to predict the movement and deposition of air pollutants, was demonstrated in a project completed for Alberta Environment. Models were modified to simulate Alberta conditions; the amounts of sulfur deposition, a key component of acid rain and acid deposition, were estimated for various geographical regions of the province. Researchers obtained field measurements at selected Alberta locations to demonstrate the ability of the models to accurately predict seasonal and annual rates of sulfur deposition. They are developing computer models that can predict the deposition of other pollutants, and their ability to cause environmental change. A prototype monitoring station is being built near Vegreville, Alberta, to test methods of measuring acidic deposition and to provide data for the validation of the new models.

A national study, to quantify seasonal variation in pavement responses to traffic loads, includes installation of pavement instrumentation at four test sites across Canada. The technology used was developed at the Alberta Research



Council as part of a long-term cooperative research program with Alberta Transportation and Utilities. The data collected from these sites will support the development of improved pavement design and evaluation processes.

The Research Council is conducting research in methods to assess the nature and movement of contaminants found in geological materials and groundwater at industrial sites in Alberta, and to evaluate the potential of available technologies for site remediation. One promising technology, in situ bioremediation, relies on naturally occurring bacteria which, under favorable conditions, are known to degrade most organic contaminants. During 1991, field and laboratory evaluation focused on the potential for in situ bioremediation of an abandoned wood preservative site in southern Alberta. The studies suggest that, although the naturally occurring bacteria are effective in degrading the chemical contaminants, the physical/hydrological characteristics of the material beneath the site limit the potential effectiveness of the technology. Additional work is required to determine whether the flow of oxygen and nutrient-bearing water can be sufficiently enhanced by artificial means to improve the effectiveness of the technology.

In cooperation with Alberta Agriculture and Agriculture Canada, the Alberta Research Council manages a soil and land resource database of the province, as support to assessors and land use planners and managers.

Forestry

A joint research venture with Weldwood of Canada, completed this year, produced an oriented strandboard panel with enhanced dimensional stability, using high moisture wood strands. A patent application has been submitted for this process, which has been transferred for scale-up to the company's mill at Slave Lake, Alberta.

The installation of a full panel-size 1220 mm x 2440 mm press has been completed. This hot press for wood composite manufacturing has capabilities unique to North America, including steam injection and hot gas injection in the manufacture of products. The technology means new areas of composites development are possible, and expands the capability of the forest products laboratory to the manufacture of large beams. A press monitoring system, Pressman™, was developed for use in the panel development pilot plant. During operation, this system monitors critically important factors such as press load, platen temperature, board temperature, and internal board gas pressure. On a press equipped with steam injection capabilities, steam flow and steam pressure can also be monitored. The user has full control of process variables.

A joint research venture with Hughes Aircraft of Canada Limited is being undertaken to develop proof of concept of an ecologically-oriented, spatial and knowledge-based framework to support forest, land and other resource management applications. Once the proof of concept has been successfully demonstrated, the technology could be transferred to forestry companies for use in their operations.

The Research Council transferred the design of the C120 Magnum trap with pan trigger for mink to a Canadian manufacturer, and participated in the writing of national and international trap standards. The wildlife section produced two humane killing traps for red squirrel and lynx. Trapping devices for Arctic fox in the Northwest Territories and New Brunswick, and raccoon in British Columbia and Quebec, were also tested. Three devices to safely handle killing traps were recognized, including development of portable pliers. The wildlife section continued to monitor the movement of fishers recently reintroduced in the Parklands of central Alberta.

Manufacturing Technologies

A research and development program has been initiated to identify, assess and develop commercial applications of powder-filled, hollow fibre technology in manufacturing, environmental and medical fields. Specific applications targeted for immediate development include oxygen enrichment, air purification and waste heat utilization.

Manufacturing Technologies and the Oil Sands and Hydrocarbon Recovery department are cooperating in the development of a regional waste management model to assist small regional groups in the use of computerized modelling techniques to design their solid waste management programs.

An automated assembly cell, designed and implemented to perform final assembly of cellular telephones, was completed for Novatel. Other projects include the design of a flow-through production line for the manufacture of water coolers that has improved production capacity and efficiency for Polar Bear/Crystal Mountain Water Coolers Ltd.

Industrial technology advisors (ITAs), located in Edmonton, Calgary, and Lethbridge, provided technical information and access to support programs such as IRAP (National Research Council's Industrial Research Assistance Program) to Alberta companies. Examples of companies benefitting from ITA assistance are Alberta Ag-Industries Ltd., a silage bag manufacturer, winner of the 1991 Alberta export award; and CAM TECH Industries, a Calgary company



that has progressed from hand cutting signs to the manufacture of CAD equipment for an international clientele.

The Gasoline and Oil Testing Laboratory is working with the Canadian Petroleum Products Institute (CPPI) to develop an equation to predict the composition of the vapors in automotive gasoline. Under contract with CPPI, the laboratory has developed the Canadian Standard test method for performing the PONA (paraffins, olefins, naphthenes, aromatics and unknowns) analyses on automotive gasoline.

Joint Research Ventures

The Joint Research Venture (JRV) program continues to be an effective technology transfer initiative for the Alberta Research Council. Since 1983, 50 projects have been undertaken - an investment totalling \$36 million, with equal financial contribution from the Alberta Research Council and participating companies. In 1991, 10 large JRVs (projects more than \$200,000) and 18 small JRVs (projects under \$200,000) were in progress.

The Alberta Research Council received its first licensing revenue from intellectual property developed from a JRV with Western Geophysical Ltd. The first patent application under a JRV has resulted from the collaboration with Canadian Flamecoat Systems Inc. in developing a new high capacity system for thermoplastic spray coating technology. As a result of other JRV work, Gienow Building Products Limited of Calgary has built a new automated facility and increased productivity by nearly 200 per cent.

In a JRV with Amptech Corporation, researchers are developing a number of prototype products in magnesium alloy and metal matrix composites by a revolutionary process called Thixomolding (TM). The project includes magnesium alloy metallurgy, product design, finite element analysis and mold design by flow modelling. Results are expected to lead to magnesium components for applications in the aerospace and automotive industries.

Northstar Drillstem Testers will be able to manufacture downhole rubber components developed under another joint research venture. These products will extend the capability of the company to meet their own production requirements and allow for international exports. A JRV was initiated with Rod Pump Specialty Valve Ltd. to develop wear and corrosion resistant alloys, coatings and ceramic components for a new downhole valve. The project involves cooperative work with The Laser Institute, Sherritt/Westaim and the Saskatchewan Research Council. A JRV with Elsro Asphalt Ltd. is developing



high value-added construction materials, incorporating post-consumer plastic waste materials.

The Product Development Assistance Program, operated as a component of the JRV program, in collaboration with the Southern Alberta Institute of Technology (SAIT), was expanded to include the Northern Alberta Institute of Technology (NAIT). Projects undertaken this year included: design assistance of an improved machine for crushing and pulverizing shipping pallets for RABCO Ltd., Airdrie; design assistance for new process equipment and plant layout for cable reel manufacturing for R & R Lumber Supplies Ltd., Blairmore; and assistance through SAIT to Innovation Inc., Calgary, on stress testing and materials analysis of a ski-tuning clamp.

Oil Sands and Hydrocarbon Recovery

A new, five-year AOSTRA/ARC/CANMET/Industry Research Program has been implemented to develop advanced in situ processes for the recovery of heavy oil and bitumen from Alberta's vast reserves. The program is co-funded by AOSTRA and the Alberta Research Council, together with 13 national and international corporations and CANMET, representing the Government of Canada. Participating organizations play a major role in developing the research program, have direct access to research results, and commercial use rights of project technology. Technical achievements from the program include: patented processes for improving reservoir sweep efficiency of steam injection processes through the use of additives, such as surfactants, gelling agents and air; injection-production protocols that counteract the deleterious effects of corrosion and scale deposition in production wells; and testing of new process concepts such as super-critical fluid extraction and down-hole hydraulic mining of an oil sands formation. The program is a model for industry-government cooperation in developing new technology needed for the economic and environmentally acceptable growth of the energy industry to the year 2000.

The AOSTRA-sponsored Strategic Program is dedicated to providing mission-oriented research in support of field pilots. A major achievement during the past year was the development of an efficient pumping system for high temperature, sand-laden fluids at high rates, conditions which are typically experienced in thermal in situ recovery.

Under contract to OSLO (Other Six Leases Operation), pilot plant testing of new processes for the extraction of bitumen from mined oil sands has been provided. Theoretical work on extraction process mechanisms has led to



improvements in processing low grade oil sands. With OSLO, a patent application related to upgrading of low quality froth, has been submitted.

A strategic objective of the Oil Sands and Hydrocarbon Recovery department is to perform applied research, in cooperation with Alberta industry, that results in new technology and products competitive in the world market. Through joint research ventures with Alberta industries, products developed include a newly patented flame-spray device for the application of plastic coatings on surfaces in highly corrosive environments (Canadian Flamecoat Inc.); a commercially available Rock Catalog which enables evaluation of the suitability of geophysical techniques for tracking the movement of miscible flood fronts in carbonate reservoirs (Western Geophysical); and a proprietary fire retardant additive for hydrocarbon-based well fracturing fluids (Trisol Inc.). Advanced testing and evaluation of new commercially developed products, prior to their introduction into the marketplace, has led to improvements in product design for a gas lift pump (Reber, Landry Oil Tool Company), and a downhole rock-perforating device (Penetrators Canada Inc.).

A geochemical computer program, named SOLMINEQ, which may be used to interpret, and then control water chemistry problems in oil production wells, has gained wide acceptance in the national and international technology market. More than 120 copies of the program, available through the Oil Sands Hydrocarbon Recovery department, have been purchased by a wide range of industries, research institutes and universities. A one-week training course in the use and application of the program was held at the Liaohe oil field, China.

A new probe has been developed by researchers and is being used by Interprovincial Pipe Line Inc. to assess advanced corrosion control strategies.

The Alberta Research Council is a partner in a sludge fundamentals consortium, set up to solve the large technical problem related to current commercial processing of mined oil sands-dewatering and consolidation of oil sand tailings sludge. Experimental and theoretical work at the Research Council has led to a new explanation of the slow settling rate of solids in the tailings ponds.

International

Manufacturing Technologies has initiated transfer of thermal spray technology to King Mongkut's Institute of Technology Thonburi (KMUTT), Thailand. In conjunction with Whiteshell Research (AECL) and Heilongjiang Academy of Sciences, Harbin, China, the department is improving the properties



of superabsorbent polymers, and developing alternate polymerization techniques using electron beams.

In a CIDA-funded (Canadian International Development Agency) joint project with Endeco International Inc., a training course in the use of technical and economic evaluation computer programs was given by Oil Sands and Hydrocarbon Recovery staff to Petro Vietnam. The objective of the course was to enable assessment of various refinery configurations which have been proposed for Vietnam.

The Alberta Research Council's Tokyo office organized a Geographic Information Systems (GIS) workshop as one of the functions marking the opening of the new Canadian Embassy. More than 200 Japanese business representatives attended the workshop, sponsored by the Research Council, the Banff Centre for Management and the Canadian government's Japan Science and Technology Fund. The Research Council and the Banff Centre sponsored a subsequent week-long GIS workshop in Banff for 20 Japanese business representatives.



nformation

The Alberta Research Council operates a number of information services at its various locations to assist clients. In 1991, staff for these services responded to more than 14,000 requests from external sources. They are:

Technology Line - A toll-free telephone line within Alberta operating as an information and referral service, offers ease of access to the technical expertise and assistance of Alberta Research Council staff. The Technology Line handles more than 3400 calls annually.

Publications - The Publications office sells technical reports, maps and other Alberta Research Council products available to clients and the general public.

Library Services - Located in five Research Council facilities in Edmonton, Calgary and Devon, with 30,000 technical volumes. The Research Council libraries offer access to a number of database collections, including SCITECH.

Industrial Information - Offers access to most of the world's published scientific and technical literature through outlets in Edmonton and Calgary.

Alberta Waste Materials Exchange - Acts as a clearing house for waste materials produced through industrial activity in Alberta, and participates with other exchanges throughout North America and in Pacific Rim countries. (Partial funding from Alberta Environment).

Information Geology - Manages several geological databases, including the province's GEODIAL.

AOSTRA Library and Information Services (ALIS) - Managed by the Alberta Research Council, ALIS is the central source for all published information on oil sands, heavy oil, and selected publications on enhanced oil recovery. (Funded by AOSTRA).

AOSTRA Oil Sands Sample Bank - Maintains a stock of oil sand, bitumen, and related material from Alberta oil sands deposits. (Funded by AOSTRA).

Mineral Core Research Facility - Includes a collection of mineral core samples and related geophysical data for the use of industry and the scientific community. (Funded by Alberta Energy).

taff Recognition

Staff, whose outstanding achievements during the year have earned them the recognition of their colleagues, are honored at an annual awards ceremony.

In 1991, a new technology transfer award was introduced. Designed by Edmonton artist, Mike Murakami, the award is a plexiglass prism set on a base of Alberta red granite. The inscription reads: *Technology Transfer is the process whereby knowledge, technology and experience are made available to users for economic benefit.*

Technology Transfer Award:

Brian Schack, Roy Masrani, Breen Liblong, Greg Sidebottom: Advanced Computing and Engineering Department - Dataspan Joint Research Venture, initiated to develop an automated document conversion software system.

Past Presidents' Award of Excellence:

Dr. Petre Toma (Professional)

Dan Wispinski (Technical)

Heather Onuczko (Support)

Patents:

Dr. Lars Bach: Canadian Patent, High Density Corrugated Waferboard Panel Products; Dr. Lars Bach, (Edward Stark, BSL Machine Ltd.): Canadian Patent, Process and Apparatus for the Manufacture of a Corrugated Wafer Board Panel Panel; Australian Patent, Pressing Corrugated Particleboard Panels.

Dr. Leszek Ignasiak, Dr. Wanda Pawlak, Dr. Jerzy Janiak, Al Turak: U.S. Patent, Process for Removing Pyritic Sulfur from Bituminous Coal.

Dr. Duncan Currie, (Dr. Mike A. Kessick, NAIT): Canadian Patent, Oil Sands Mining.

Best Paper:

Dr. V.S.V. (Raj) Rajan (Dr. Steve G. Dunn, Dr. Emil H. Nenniger, Hatch Associates): A Study of Bitumen Recovery by Gravity Drainage Using Low Temperature Soluble Gas Injection. Awarded Best Paper published in the Canadian Journal of Chemical Engineering.

External Professional Awards:

Helga Petri, AOSTRA Library and Information Services: Awarded life membership in the Canadian Institute of Energy for outstanding contribution to the institute since 1984.



Long-term Service (25 years):

Maralyn Shepley
Dr. Zac George (retired)
Ford Bergwall

Senior Level Promotions:

Deborah Henry to Research Technologist IV
Gerald Pierce to Research Technologist IV
Lindsay Logan to Research Technologist IV
Linda Coates to Research Technologist IV
John Woolley to Research Technologist IV

Safety:

Individual award: Lisa Hermanutz.

Team award: Leo Regnier, Roslyn Grieve, Kelly Allen, Shirley Logan,
Grant Reekie, David Kufeldt, Doug Coolidge, Bruce Mallas, David Bilyk,
Rob Wellwood, Steve Lee, Peter Taylor, Steve Kirincic, Greg Philp.

Invited Lecture:

Dr. Leszek Ignasiak: Amoco-Argonne Coal Chemistry Research
Program - Distinguished Seminar at Amoco Research Centre at Naperville,
Illinois, July, 1990. Alberta Research Council.

Scholarships:

Datong Guo, University of Calgary
(Alberta Research Council scholarship).
Sheila Luther, University of Alberta
(Karl A. Clark Memorial scholarship).

oard of Directors

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Alberta Research Council

Honourable Fred A. Stewart – Minister
Technology, Research and Telecommunications

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Canadian Institute for Advanced Research, Calgary

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Dept. of Biochemistry and Biological Sciences
University of Calgary

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Sherritt Gordon Limited, Fort Saskatchewan

Dr. Brian L. Barge* – President
Alberta Research Council

* Member of Executive Committee

December, 1991



Auditor's report

To the Board of Directors of the Alberta Research Council

I have audited the balance sheet of the Alberta Research Council as at March 31, 1991 and the statement of revenue, expenditure and equity for the year then ended. These financial statements are the responsibility of the Research Council's management. My responsibility is to express an opinion on these financial statements based on my audit.

I conducted my audit in accordance with generally accepted auditing standards. Those standards require that I plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In my opinion, these financial statements present fairly, in all material respects, the financial position of the Research Council as at March 31, 1991 and the results of its operations and the changes in its financial position for the year then ended in accordance with the disclosed basis of accounting as described in Note 2 to the financial statements.

Ronald D. Salmon

FCA

Auditor General

Edmonton, Alberta

June 28, 1991

Alberta Research Council

Balance Sheet

as at March 31, 1991 (thousands of dollars)

Assets	1991	1990	Liabilities and Equity	1991	1990
Current:			Current:		
Cash	\$ 5,254	\$ 3,345	Accounts payable	\$ 4,442	\$ 3,597
Accounts receivable	8,281	6,231	Unearned contract revenue	3,227	998
Accrued income receivable	2,503	2,293	Payable to joint research ventures	23	-
Prepaid expenses	178	304		<u>7,692</u>	<u>4,595</u>
Advances to joint research ventures	-	221			
Current portion - deferred pension costs (Note 3)	<u>73</u>	<u>73</u>			
	<u>16,289</u>	<u>12,467</u>			
Non-current:			Equity:		
Deferred pension costs (Note 3)	146	219	Capital assets (Note 6)	60,708	55,919
Investment in limited partnership (Note 4)	<u>200</u>	<u>200</u>	Operating	6,119	4,551
	<u>346</u>	<u>419</u>	Special purpose, Schedule 1	<u>2,824</u>	<u>3,740</u>
Capital:				<u>69,651</u>	<u>64,210</u>
Equipment (Note 5)	60,708	55,919		<u>77,343</u>	<u>68,805</u>
	<u>77,343</u>	<u>68,805</u>			
Trust Fund:			Trust Fund:		
Cash	<u>124</u>	<u>194</u>	Liability	<u>124</u>	<u>194</u>
	<u>\$77,467</u>	<u>\$68,999</u>		<u>\$77,467</u>	<u>\$68,999</u>

The accompanying notes are part of these financial statements.

Statement of Revenue, Expenditure and Equity

for the year ended March 31, 1991 (thousands of dollars)

	Operating	Special Purpose (Schedule 1)	Total	
			1991	1990
Revenue				
Grants from Province of Alberta:				
General Revenue Fund	\$25,051	\$3,100	\$28,151	\$24,450
Contract revenue:				
Provincial government departments and agencies	12,510	—	12,510	10,003
Other	16,129	37	16,166	13,199
	<u>53,690</u>	<u>3,137</u>	<u>56,827</u>	<u>47,652</u>
Expenditure				
Salaries, wages and benefits	32,373	226	32,599	29,457
Supplies and services	13,768	1,156	14,924	12,853
Capital assets	5,981	238	6,219	4,847
Joint research ventures	—	2,433	2,433	3,270
	<u>52,122</u>	<u>4,053</u>	<u>56,175</u>	<u>50,427</u>
Net revenue (expenditure) for year	1,568	(916)	652	(2,775)
Equity at beginning of year	<u>4,551</u>	<u>3,740</u>	<u>8,291</u>	<u>11,066</u>
Equity at end of year	<u>\$6,119</u>	<u>\$2,824</u>	<u>\$8,943</u>	<u>\$8,291</u>

Notes to the Financial Statements

March 31, 1991

Note 1: Authority

The Alberta Research Council operates under the authority of the Alberta Research Council Act, Chapter A-35.1, Statutes of Alberta 1981.

Note 2: Summary of Significant Accounting Policies and Reporting Practices

(a) General

These financial statements have been prepared in accordance with generally accepted accounting principles except with regard to the recording of capital assets. Purchases of capital assets are charged to operations in the year of acquisition. On the balance sheet, capital assets are recorded at original cost, or at estimated cost, with the offsetting credit to capital assets equity.

(b) Payable to Joint Research Ventures

Payable to joint research ventures is recorded as a liability of the Research Council. The liability is reduced as the Research Council pays for its share of joint research venture expenses.

(c) Patents

Expenditures for patents owned by the Research Council as a result of research activity are not capitalized due to the uncertain value of benefits which may accrue to the Research Council.

(d) Contract Revenue Recognition

Contract revenue is recognized as costs are incurred, up to the contract maximum and in accordance with contracted cost-sharing ratios. The Research Council makes full provision for all known or estimated losses on uncompleted contracts as soon as they can reasonably be estimated.

(e) Investment

The Research Council is a minority shareholder in International Permeation Inc. The equity allocated to the Research Council was based on the technological "know how" acquired by International Permeation Inc. from a former company to which the Research Council provided research and technological expertise and was the majority shareholder.

The Research Council's equity in the company is not reflected in these financial statements due to the uncertain value of benefits which may accrue to the Research Council.

(f) Special Purpose Equity

Special purpose equity is to be used only for future expenditures related to those activities listed on Schedule 1.

(g) Trust Liability

Trust funds are contributions received from other government departments under research agency agreements which require the Research Council to administer the contributions and provide accounting services.

(h) Changes in Financial Position

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 3: Deferred Pension Costs

Total past service pension costs for employees joining the management pension plan prior to April 1, 1988 are being amortized on a straight-line basis over six years.

	1991	1990
Balance at end of year	\$218,540	\$291,386
Less: Current portion	<u>72,846</u>	<u>72,846</u>
Non-current portion	<u>\$145,694</u>	<u>\$218,540</u>

Amortization of deferred past service costs amounted to \$72,846.

Note 4: Investment in Limited Partnership

The Research Council has purchased one limited partnership unit comprising 11% in Spurt Investment Fund I, a venture capital fund designed solely to make equity investments in seed and early stage technology enterprises.

The investment is recorded under the cost basis of accounting.

	1991	1990
Original cost	\$300,000	\$300,000
Less: Amount written off	<u>100,000</u>	<u>100,000</u>
Book value	<u>\$200,000</u>	<u>\$200,000</u>

Note 5: Capital Assets

Capital assets purchased subsequent to April 1, 1981 are valued at cost. Those purchased prior to April 1, 1981 by the Research Council are at estimated cost. Included in capital assets are certain capital assets purchased as a result of research contracts which specify that the Research Council does not receive title until completion of the contract or at the discretion of the sponsor.

(Note 5 continued)

Capital assets comprise:

	1991	1990
Owned by the Research Council	\$57,678,230	\$52,733,499
Held by the Research Council on behalf of other government agencies and third parties	2,898,779	2,868,153
Owned by the Research Council and held by joint venture parties	131,392	317,547
	<u>\$60,708,401</u>	<u>\$55,919,199</u>

Note 6: Capital Assets Equity

	1991	1990
Balance at beginning of year	\$55,919,199	\$52,350,707
Add: Additions at cost	6,201,633	5,001,374
	62,120,832	57,352,081
Less: Disposals at cost	1,412,431	1,432,882
Balance at end of year	<u>\$60,708,401</u>	<u>\$55,919,199</u>

Note 7: Obligations Under Operating Leases

Year ending March 31, 1992	\$278,509
1993	176,092
1994	162,224
1995	113,224
1996	5,420
	<u>\$735,469</u>

Note 8: Unreflected Activities

(a) Occupancy and Office Furniture Expenditure

The premises occupied by the Research Council and some office furniture have been provided by the Province of Alberta at no cost.

(b) Interest Revenue

Interest earned on the Research Council's Canadian dollar bank account is retained by the Province of Alberta.

Note 9: Approval of Financial Statements

These financial statements were reviewed by management and recommended to the Board for approval.



Alberta Research Council

**Schedule of Special Purpose Revenue,
Expenditure and Equity**

Schedule I

for the year ended March 31, 1991 (thousands of dollars)

	Joint Research Ventures Program	Mill Woods/ Devon Fitting Up	Bio- technology Toll Facility	Total	
				1991	1990
Revenue					
Grants from Province of Alberta:					
General Revenue Fund	\$3,100	\$ -	\$ -	\$ 3,100	\$ 3,100
Contract revenue	37	-	-	37	-
	3,137	-	-	3,137	3,100
Expenditure					
Salaries, wages and benefits	213	11	2	226	236
Supplies and services	-	28	1,128	1,156	770
Capital assets	1	209	28	238	1,241
Joint research ventures	2,433	-	-	2,433	3,270
	2,647	248	1,158	4,053	5,517
Net revenue (expenditure) for year	490	(248)	(1,158)	(916)	(2,417)
Transfer to operating equity	-	-	-	-	(525)
	490	(248)	(1,158)	(916)	(2,942)
Balance at beginning of year	2,092	280	1,368	3,740	6,682
Balance at end of year	\$ 2,582	\$ 32	\$ 210	\$ 2,824	\$ 3,740

taff List*

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T. Kaneda D.Sc. (Tokyo)

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A.S. Green Food Tech (NAIT)

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J.M. Curtis B.Sc. (Manitoba)

* December 1991

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W.T. Leps
G. Macaloney
J.M. Marowitch
F.J. Merchant
R. Merchant
P. Nagarajan

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T.Y. Malcolm
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Bio Sci (NAIT)
Bio Sci (NAIT)
Bio Sci (NAIT)
Bio Sci (NAIT)
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B.Sc. (Alberta)
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B.Sc. (Alberta)

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B.G. Young HNC Telecom (London)

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 W. Pawlak Ph.D. (Poznan)
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 S. Petrovic Ph.D. (Dresden)
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